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(54) RDS receiver comprising the selection of broadcast programmes carrying traffic signals, while reproducing programmes from other sources

(57) When an RDS or RBDS radio is used to listen to prerecorded media, the tuner monitors an RDS station in the background to determine when a traffic announcement is in progress. A search for selecting an appropriate station for background monitoring is provided which selects a station which is most likely to be in accordance with the individual preferences of the driver. The search method can also be used to find traffic capable stations, weather stations, emergency alert information, and news broadcasts.

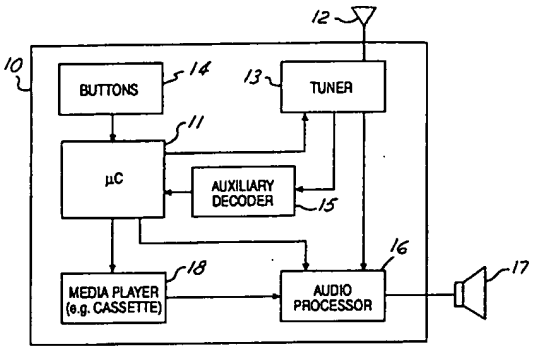

FIG.1

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Description

BACKGROUND OF THE INVENTION

[0001] The present invention relates in general to background monitoring of an RDS radio broadcast for traffic announcements, and more specifically to a search strategy for selecting a traffic capable station to be monitored when reproducing other audio media such as a cassette tape, compact disk, or a radio station without traffic capability.

[0002] Radio data systems such as the RDS system in Europe and the radio broadcast data system (RBDS) in the United States transmit auxiliary information with the radio broadcast including a traffic capable (TP) flag to identify broadcast stations which carry traffic announcements and a traffic announcement (TA) flag for identifying that a traffic announcement is currently being transmitted by the broadcast station. Other RDS flags are transmitted to identify emergency alert messages, news broadcasts, and weather announcements, for example. These flags allow a radio receiver to be tuned to a broadcast station that provides traffic information for a driver of an automobile. In addition, a radio receiver can monitor a traffic capable station during times that the audio system is reproducing audio signals from a source other than a traffic capable radio station (such as a cassette tape or compact disk; or even an AM radio station or a non-capable FM radio station if a separate radio tuner is available).

[0003] By monitoring the flags of a traffic capable station in the background while the audio system reproduces audio signals from other media, it is possible for the audio system to automatically switch to the traffic announcement when one is present thereby keeping the driver of a vehicle informed of traffic developments while driving. Whenever listening to an audio source which is not a traffic capable broadcast station, a search strategy must be adopted to find an appropriate broadcast station to be monitored in the background. If the last broadcast station to which the tuner was tuned before switching to the alternate media is not a traffic capable station, then a different station must be selected automatically by the receiver. Prior art receivers typically perform a standard station scan to find an RDS station transmitting the TP flag and have used either the first traffic capable station which is found or the strongest traffic capable station found during a search of the complete band.

[0004] A broadcast station which is traffic capable may or may not satisfy the individual preferences of an individual driver. The format, language, frequency, or coverage area of traffic announcements from various stations will vary. Therefore, an arbitrary search for a traffic-capable broadcast station can easily fail to provide the most optimal station for matching the preferences of any individual driver.

SUMMARY OF THE INVENTION

[0005] The present invention uses a search sequence for a traffic-capable broadcast station which increases the likelihood that the driver will get traffic announcements according to their individual preferences. In particular, the invention uses a search strategy giving preferences to broadcast stations stored in memory presets of the radio where listeners tend to store their favorite stations.

[0006] In one aspect, the invention provides a method for selecting a broadcast station for background monitoring to detect predetermined events as identified by a data flag transmitted within auxiliary data of a radio system while an audio system is reproducing audio signals from a source other than a broadcast station capable of transmitting the predetermined events. As a first step, auxiliary data is searched from respective broadcast stations until a broadcast station is found transmitting or capable of transmitting the data flag. Once a broadcast station is found, its auxiliary data is monitored to detect when a predetermined event is in progress. The searching step inspects broadcast stations saved in memory presets prior to conducting any scan of frequencies across the radio band.

BRIEF DESCRIPTION OF THE DRAWINGS

[0007]

Figure 1 is a block diagram showing an audio system according to the present invention.

Figure 2 is a flowchart showing the search sequence of the present invention.

Figure 3 is a flowchart showing a fallback search used in the present invention.

Figure 4 is a flowchart showing the background monitoring function of the present invention.

DETAILED DESCRIPTION OF PREFERRED EMBODIMENTS

[0008] As shown in Figure 1, an RDS or RBDS radio receiver 10 operates under control of a microcontroller 11. Radio broadcast signals are picked up by an antenna 12 and relayed to a tuner 13 which tunes to a frequency under the control of microcontroller 11. The user can control the frequency of tuning via the radio buttons 14. If a received broadcast signal is an RDS or RBDS signal including auxiliary data, then the auxiliary data is decoded by an auxiliary decoder 15 connected between tuner 13 and microcontroller 11.

[0009] Audio signals from tuner 13 are processed through an audio processor 16 before being reproduced by a speaker 17. A media player 18 such as a cassette tape player or compact disk player provides audio signals to audio processor 16 during playback. Media player 18 and audio processor 16 operate under control

of microcontroller 11.

[0010] When audio system 10 is reproducing audio signals from media player 18, microcontroller 11 can use tuner 13 and auxiliary decoder 15 to monitor for traffic announcements or other information (e.g., emergency alert, weather, or news) which a driver may desire during driving. When a traffic announcement or other information is detected, microcontroller 11 can pause media player 18 and switch audio processor 16 over to the broadcast station transmitting the traffic announcement or other information. If tuner 13 is a dual tuner with two separate tuning circuits, this function can even be performed when listening to a non-traffic capable radio station.

[0011] The preferred method for selecting a broadcast station to monitor in the background for traffic announcements or other information is shown in Figure 2. The method starts at step 20 upon the entry of the audio system into a media other than an FM station containing traffic announcement capability. In step 21, the tuner is set to the last FM band to which the radio receiver was tuned (i.e., to band FM1 or FM2 which are commonly used in automotive radios to increase the number of station presets). In step 22, the tuner is set to the last tuned frequency in the last FM band. A check is made to determine whether a listenable (i.e., receivable with a predetermined quality) station is present on the tuned-in frequency in step 23. If a listenable station is detected then the transmission is checked for the required data in step 24. For example, if checking for traffic capability, the TP flag is checked in the RDS data. Other data flags include a TA flag for a traffic announcement is progress, a weather announcement flag, an emergency alert, a news broadcast, or other RDS categories. If the required data is present, then the method is exited in step 25 and the radio receiver monitors the station for the desired event (e.g., a traffic announcement).

[0012] If the required data is not present or the frequency does not contain a listenable station, then the tuner is set to the first preset of the current band in step 26. A check is made for a listenable station in step 27 and for the required data in step 28. If they both are present, then the method is exited at step 30 and the current station is monitored for activity. If the current frequency does not contain a listenable station or if the required data is not present, then a check is made in step 31 to determine whether all presets in the band have been checked. If they have not, then the tuner is set to the next preset in the current band in step 32 and a return is made to step 27. If all presets have been checked, then a check is made in step 33 to determine whether all FM or RDS bands have been checked. If a band remains to be checked, then the tuner is set to the next band in step 34 and a return is made to step 22. If all bands have been checked then a fallback search is performed in step 35 in an attempt to find some other traffic capable station. The method is exited in step 36.

[0013] The fallback search in step 35 can be a standard seek of all sequential frequencies in the FM band. Alternatively, a preference may be given to stations having programmed types matching those of the presets as shown in Figure 3. Consequently, if the alternate media is paused in order to reproduce a traffic announcement or other data, the method of Figure 3 allows a station to be selected that has a program type that matches at least one type of station that the user has stored in a memory preset. Thus, the program type codes are retrieved associated with all of the FM presets in step 40. In step 41, a seek to sequential frequencies in the band is performed to find a receivable station. In step 42, a check is made to determine whether the full band has been scanned. When a station is found, a check is made in step 43 to determine whether the station is listenable and has the required data. Failing either of these requirements, a return is made to step 41 to continue the scan of the band. If a listenable station is found with the required data, a check is made is step 44 to determine whether the station has a matching program type code. Thus, if the stations stored in memory presets have program type codes of news, talk, and rock, then step 44 determines whether the station that it has found with the required data matches any of these program type codes. If no match is found, then the frequency of the station is saved in step 46 and a return is made to step 41 to continue the scan. If the program type code is a match, then the method is exited in step 45 and the receiver monitors the found station.

[0014] In step 42, if the full band has been scanned without finding a traffic capable station with a matching program type code, then a check is made in step 47 to determine whether a frequency has been saved for a traffic capable station without a matching program type code. If more than one such stations have been found, then a selection can be performed based on signal strength or any other desired criteria. The selected station is used for monitoring in step 45. If no station frequency has been saved, then no station is receivable satisfying the desired criteria of being traffic capable. Since the receiver was unable to find a station, it restarts the search in step 48 after a delay or with a substitute criteria for selecting the station (e.g., a different RDS flag is sought). For example, a first search may be conducted looking for a traffic announcement in progress, and a subsequent search may be made for a traffic capable station if no traffic announcement was found to be in progress.

[0015] A preferred embodiment for performing background monitoring is shown in Figure 4. In step 50, a timer is started in order to measure a time when a new search should be conducted for a desired background station. In step 51, a check is made to determine if the predetermined activity or event is present or in progress. For example, if the predetermined event being monitored for is a traffic announcement, then a check is made of the auxiliary data to determine if the TA flag has

been set. If the activity is present, then the alternate audio media is paused in step 52 and the audio system is switched to the monitored station in order to reproduce the predetermined event, such as the traffic announcement. If no activity is detected, then a check is made in step 53 to determine whether the station is still listenable. If the station has become unlistenable, then the search for a broadcast station is restarted in step 54. If the station is still listenable, then a check is made in step 55 to determine if the timer has expired. A time delay of a few minutes is preferred so that if the vehicle moves into an area where a more preferred background monitoring station has become receivable then it will be substituted as the monitored station. If the timer has expired, then the search is restarted in step 54. If the timer has not expired, then a return is made to step 51 to check for activity.

Claims

1. A method for selecting a broadcast station for background monitoring to detect predetermined events as identified by a data flag transmitted within auxiliary data of a radio data system while an audio system is reproducing audio signals from a source other than a broadcast station capable of transmitting said predetermined events, said method comprising the steps of:

   searching said auxiliary data received from respective broadcast stations until a broadcast station is found transmitting or capable of transmitting said data flag; and
   monitoring auxiliary data of said found broadcast station to detect when a predetermined event is in progress;
   wherein said searching step inspects broadcast stations saved in memory presets prior to conducting a scan of frequencies across a radio band.

2. The method of claim 1 wherein said predetermined events are traffic announcements and / or emergency alert messages and / or news broadcasts and / or weather announcements.

3. The method of claim 1 or 2 further comprising the steps of:

   if said searching is completed without finding a broadcast station capable of broadcasting said predetermined events, then:
   searching said auxiliary data received from respective broadcast stations until a broadcast station is found transmitting or capable of transmitting alternate events; and
   monitoring said auxiliary data of said found broadcast station to detect when an alternate event is in progress.

4. The method of claim 3 wherein said searching step for said alternate events inspects broadcast stations saved in memory presets prior to conducting a scan of frequencies across a radio band.

5. The method of claim 3 wherein said predetermined events are traffic announcements in progress and wherein said alternate events are traffic announcement capability.

6. A method for selecting a broadcast station for background monitoring for traffic announcements in a radio data system while an audio system is reproducing audio signals from a source other than a broadcast station capable of broadcasting a traffic announcement, said method comprising the steps of:

   searching auxiliary data received from respective broadcast stations until a broadcast station is found which identifies itself as being traffic capable; and
   monitoring auxiliary data of said found broadcast station to detect when a traffic announcement is in progress;
   wherein said searching step inspects broadcast stations saved in memory presets prior to conducting a scan of frequencies across a radio band.

7. The method of claim 6 wherein said searching step inspects broadcast stations in the order of:

   last tuned station;
   scan of presets; and
   scan through sequential frequencies in said radio band.

8. The method of claim 6 wherein said searching step inspects broadcast stations in the order of:

   last tuned station in active FM band;
   scan of presets in active FM band;
   last tuned station in inactive FM band;
   scan of presets in inactive FM band;
   and scan through sequential frequencies across said radio band.

9. The method of claim 6 wherein said searching step inspects broadcast stations in the order of:

   last tuned station in active FM band;
   scan of presets in active FM band;
   last tuned station in inactive FM band; scan of presets in inactive FM band; scan through sequential frequencies across said

radio band with an additional requirement that a broadcast station must have a program type code that matches a program type code for at least one broadcast station stored as a preset; and

selecting a station from said scan through [0 sequential frequencies without regard to said additional requirement.

10. The method of claim 6 further comprising the step of: automatically reproducing a traffic announcement when it is detected.

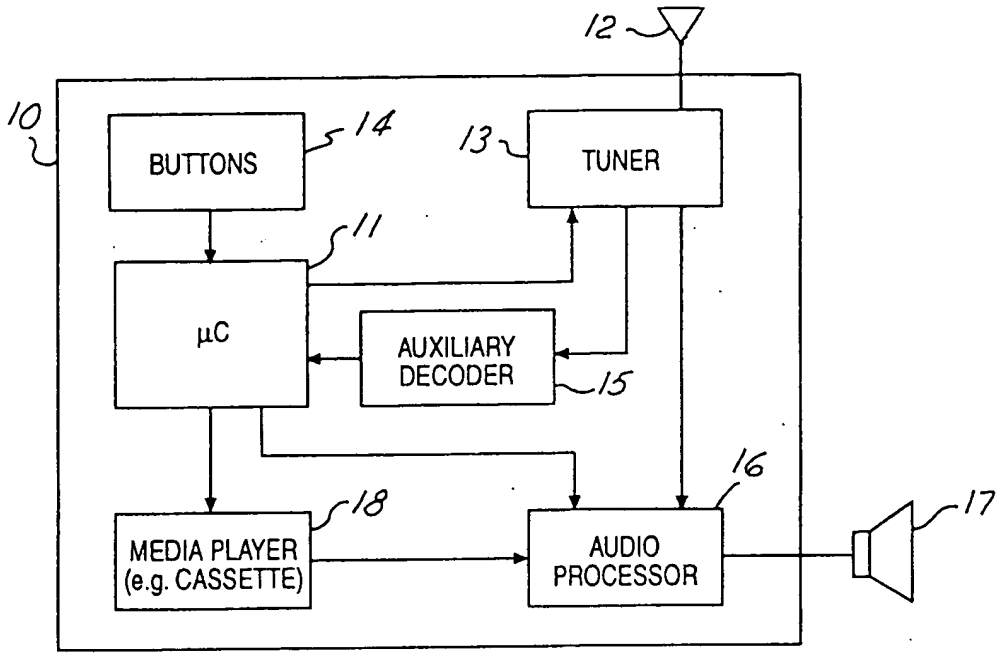
12
10
BUTTONS
14
13
TUNER
11
µC
AUXILIARY DECODER
15
16
18
17
MEDIA PLAYER (e.g. CASSETTE)
AUDIO PROCESSOR

FIG. 1

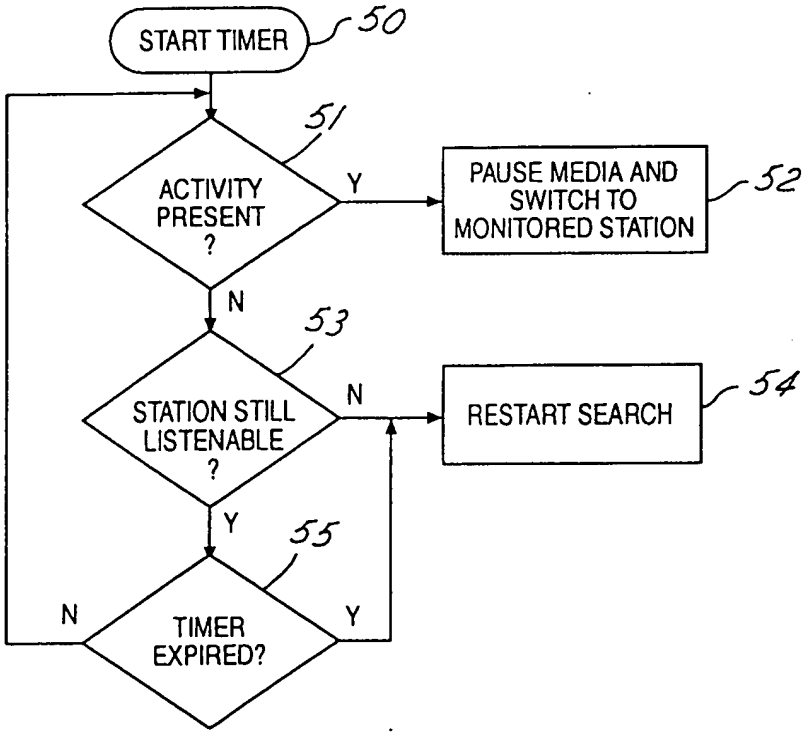
START TIMER
50
51
ACTIVITY PRESENT ?
Y
PAUSE MEDIA AND SWITCH TO MONITORED STATION
52
N
53
STATION STILL LISTENABLE ?
N
RESTART SEARCH
54
Y
55
N
TIMER EXPIRED?
Y

FIG. 4

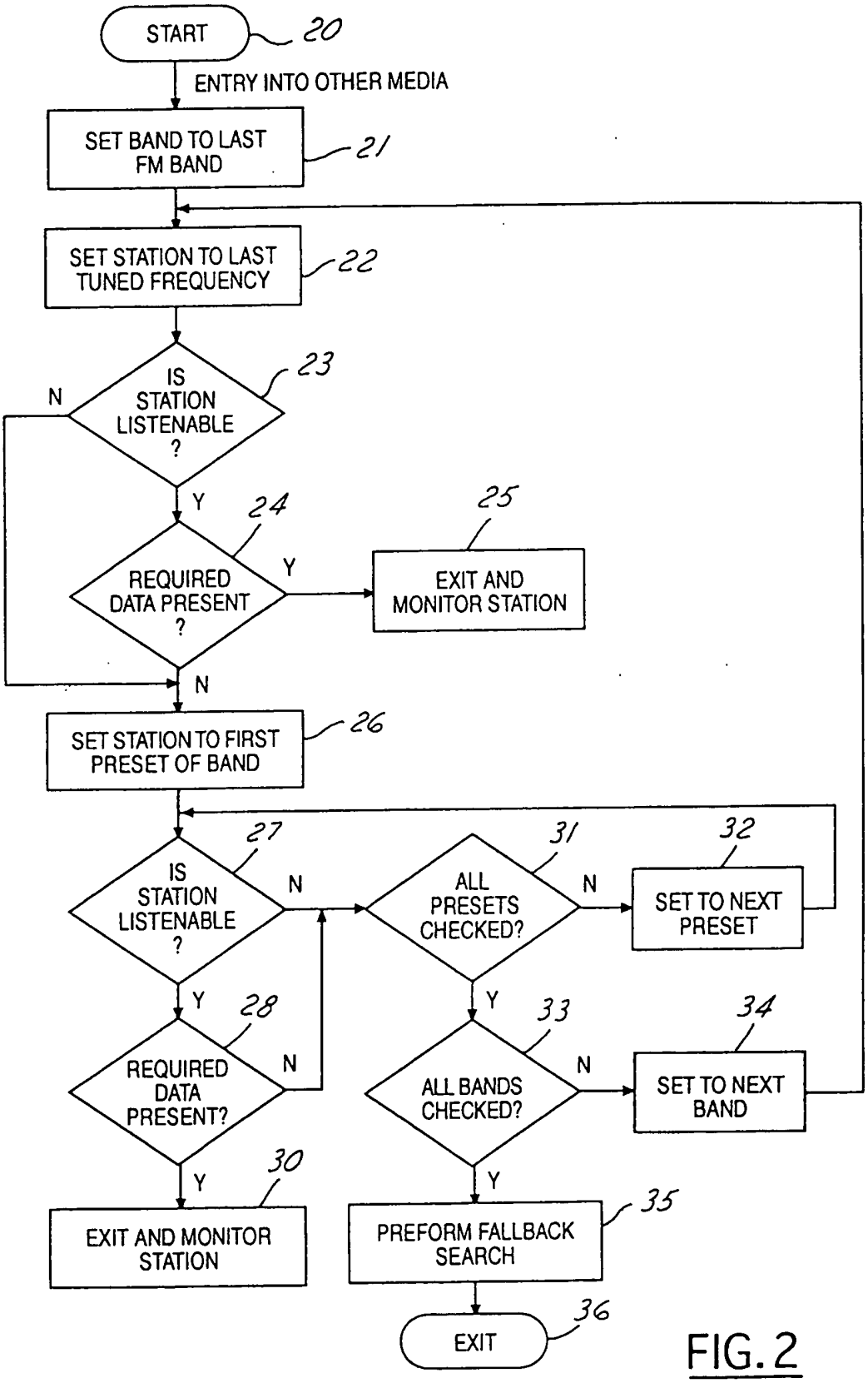
START
20
ENTRY INTO OTHER MEDIA
SET BAND TO LAST FM BAND
21
SET STATION TO LAST TUNED FREQUENCY
22
IS STATION LISTENABLE ?
23
N
Y
REQUIRED DATA PRESENT ?
24
Y
25
EXIT AND MONITOR STATION
N
SET STATION TO FIRST PRESET OF BAND
26
IS STATION LISTENABLE ?
27
N
Y
REQUIRED DATA PRESENT?
28
N
Y
EXIT AND MONITOR STATION
30
ALL PRESETS CHECKED?
31
N
SET TO NEXT PRESET
32
Y
ALL BANDS CHECKED?
33
N
SET TO NEXT BAND
34
Y
PREFORM FALLBACK SEARCH
35
EXIT
36

FIG. 2

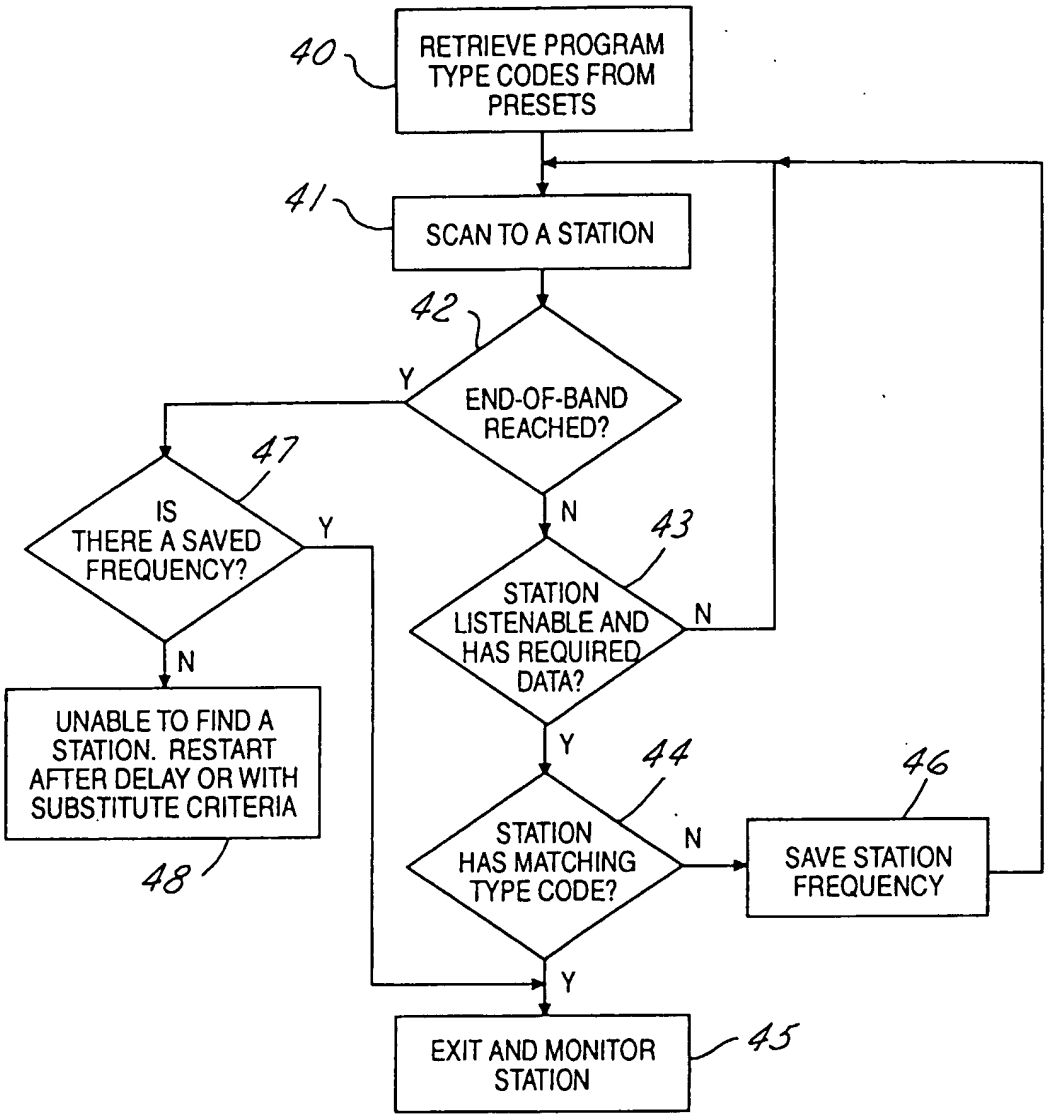
40
RETRIEVE PROGRAM TYPE CODES FROM PRESETS
41
SCAN TO A STATION
42
END-OF-BAND REACHED?
Y
N
47
IS THERE A SAVED FREQUENCY?
Y
N
43
STATION LISTENABLE AND HAS REQUIRED DATA?
N
Y
44
STATION HAS MATCHING TYPE CODE?
N
Y
46
SAVE STATION FREQUENCY
UNABLE TO FIND A STATION. RESTART AFTER DELAY OR WITH SUBSTITUTE CRITERIA
48
EXIT AND MONITOR STATION
45

FIG. 3